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(54) **Abrasive articles and their production**

Schleifkörper und Verfahren zu ihrer Herstellung

Articles abrasifs et leur fabrication

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(56) References cited:
GB-A- 2 043 501
US-A- 3 576 090
US-A- 4 910 924

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Description

[0001] This invention relates to thermoformed abrasive articles and processes therefor. More particularly, but not exclusively, the present invention relates to an abrasive pad or other abrasive articles such as a lapping tool or abrasive wheels which are injection moulded.

[0002] In the past, the use of abrasive pads, which include abrasive resinoid segments attached to backing substrates, has been common when polishing stones and marbles and other materials. In view of the relatively thick and non-yielding resinoid segments generally used in these pads, it has ben problematic to provide a flexible type abrasive pad using these types of segments. In the past, these segments have been attached to backing substrates, such as fabrics or the like, utilizing a large number of small segments to produce a flexible abrasive pad. Such abrasive pads are commonly used on rotary polishers for finishing of marble floor surfaces, for instance. While these structures have been useful as rotary polishing pads, the operational life of the pads has been low. This is because of detachment of segments during use.

[0003] Therefore, it was a goal in the art to produce a long lasting flexible "segmented-type" abrasive sheet material which would have increased durability and be less subject to loss of abrasive portions during use. This goal has lead to the discovery that thermoplastic materials can be used in abrasive pads.

[0004] It has now been discovered that a broad range of abrasive articles can be injection moulded in an economical and efficient process. In the past, thermosets of thermoset-like materials have primarily been utilized for abrasive articles because of their ability to withstand the high temperatures associated with abrasive operations. For purposes herein "thermoset" refers to polymer materials which chemically cross-link and are not reworkable at substantially the same temperature.

[0005] GB 2 043 501 A discloses an abrading member that is particularly suited to grind and smooth lenses. The abrading member is a pad that includes a slotted disc which is flat on one side for attachment to a tool. The other side is formed with spaced apart projections. The pad is made by moulding a mixture of thermoplastic material and abrasive particles in a mould of the desired shape.

[0006] It is a goal of the present invention to provide an abrasive pad that is an improvement over the known abrasive pads.

[0007] According to a first aspect of the present invention, there is provided an abrasive article comprising a moulded abrading body produced from an injection moulded polymeric material with an abrasive material and a secondary filler material interspersed homogeneously therethrough, the abrading body comprising from 1% to 20% by volume of a diamond hardness abrasive grit; from 5% to 80% by volume of a secondary filler; and from 5% to 90% by volume of a thermoformable polymer selected from thermoplastic polymeric materials having a softening point temperature greater than 100°C and less than 250°C, and thermoset polymers.

[0008] The filler may be selected from silicon carbides, aluminium oxides, corundums and mixtures thereof; or selected from powder metals, powdered organic materials, powdered inorganic materials and mixtures thereof.

[0009] Any of the abrasive articles according to the present invention may include a substrate, with the body injection moulded onto the substrate.

[0010] Unless the body is to be flexible, the body can be injection moulded from a thermosetting polymeric material.

[0011] Alternatively, the body may be injection moulded from a thermoplastic polymeric material, for example one selected from polypropylenes, polyethylenes, nylons, polycarbonates and mixtures thereof.

[0012] According to another aspect of the present invention, there is provided a process of manufacture of an abrasive article, comprising the steps of:

a) providing an injection mould cavity for forming a predetermined shape of the abrasive article;
b) formulating a fluid mixture, said mixture comprising from 1% to 20% by volume diamond hardness abrasive grit, from 5% to 80% by volume secondary filler(s) and from 5% to 90% of a thermoformable polymer selected from thermoplastic polymers having a softening point temperature greater than 100°C and less than 250°C and thermoset polymers; and
c) injection moulding the abrasive article by forcing the fluid mixture into the injection mould cavity.

[0013] The abrasive pad of the present invention provides a one-piece pad which increases the longevity of the pad during normal use, such as finishing of marble floors or flat edges and radius edges of counter tops.

[0014] In accordance with the methods and products of the present invention a variety of abrasive structures can be produced via injection molding. Additional benefits and advantages of the present invention will become apparent from the subsequent description of the preferred embodiments and the appended claims taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

[0015]

Fig. 1 is a perspective view of an abrasive pad made in accordance with the teachings of the present invention;
Fig. 2 is a sectional view illustrative of a process, for manufacture of an abrasive pad;
Fig. 3 is a sectional view of an alternate embodiment of an abrasive pad made in accordance with

the teachings of the present invention;

Fig. 4 is a sectional view of the abrasive pad of Fig. 1;

Fig. 5 is a front plan view of an alternate embodiment of an abrasive pad which is injection molded;

Fig. 6 is a rear plan view of the abrasive pad of Fig. 5;

Fig. 7 is a sectional view of the abrasive pad of Fig. 5 taken along line 7-7;

Fig. 8 is a top perspective view of an abrasive article in the form of a lapping tool made in accordance with the teachings of the present invention;

Fig. 9 is a bottom perspective view of the abrasive article of Fig. 8;

Fig. 10 is a sectional view of the abrasive article of Fig. 8 taken along line 8-8; and

Fig. 11 is a detailed section taken from area 11 in Fig. 10.

Description of the Preferred Embodiments

[0016] In its broadest aspects, the present invention discloses a method and product for forming an abrasive article utilizing injection molding. Referring now to the drawings, according to the present invention there is provided a flexible one-piece abrasive sheet, such as pad 10. The one-piece abrasive pad 10 includes a flexible planar sheet portion 12 which has a plurality of abrasive protrusions 14 extending therefrom. The protrusions 14 are intimately molded with the sheet portion 12. In a first preferred embodiment injection molding of a thermoplastic material which has an intimate mixture of an abrasive grit material therein is used. In a second embodiment a thermosetting material which includes an abrasive grit material intermixed therein may be used to injection mold abrasive articles.

[0017] In a preferred embodiment of the present invention, the pad 10 is formed in a circular embodiment with a peripheral lip portion 16 extending in the same direction as the protrusions 14. The lip portion 16 advantageously allows the pad to climb over obstacles in an irregular surface without damaging the abrasive protrusions 14. The advantage of the lip portion 16 is set forth in more detail in my co-pending United States Patent Application Serial Number 502,056 Entitled "Marble, Granite and Stone Finishing Method and Abrasive Pads Therefor", filed March 30, 1990. The protrusions 14 have outer abrasive end surfaces 18 which are co-planar to one another. Preferably lip 16 is also co-planar to these peripheral edges 18. The pad 10 includes a central orifice 20 which is provided for fitting on a particular rotary tool to provide clearance during use. A means for attachment to a polishing tool, such as a velcro hook and loop fastener 21 is attached to the back of the pad 10. Such velcro attachments are common in the rotary tools used today. However, other means for attachment could readily be adapted as a particular tool required.

[0018] Referring now to Fig. 4, in a preferred embodiment a strengthening element 22 is integral with the backing portion 12. The strengthening element 22 may be any of a number of materials which have a plurality of apertures therethrough. A suitable strengthening element provides strengthening to the pad while retaining flexible characteristics of the backing portion 12 during use. In a preferred embodiment the strengthening element 22 is a woven mesh material such as a fiberglass mesh material, as shown in Fig. 4. In the embodiment shown in Fig. 4, the mesh material is embedded in the thermoplastic during the forming of the sheet portion 12.

[0019] Referring now to Fig. 3, there is shown an alternate embodiment of an abrasive pad, generally shown at 110. In the figures like numerals differing by 100 refer to like elements in the alternate embodiment 110. The alternate embodiment 110 is similar to the embodiment 10, however a perforated phenolic sheet material 124 is utilized as a strengthening element in place of the strengthening mesh 22. In this embodiment the thermoplastic is molded in-situ with the phenolic board such that the thermoplastic progresses through the perforations in the phenolic board material. The phenolic sheet material 124 is attached to the thermoplastic due to the compatible adhesive characteristics of the thermoplastic and the phenolic board and also due to the mechanical interlock of the protrusion 114 with the apertures 126 in the phenolic sheet material 124. A NEMA grade G-3 phenolic board, such as that utilized in circuit board applications, is a preferred material for this embodiment.

[0020] It is critical in a thermoplastic article of the present invention that thermoplastic materials useful in the present invention are true thermoplastics which may be formed and re-formed at substantially the same temperature. It is critical in the thermoplastic embodiments of the present invention that the working temperature of the thermoplastic be greater than about 100°C but less than about 250°C. If the working temperature drops below the 100°C temperature the heat created during use of the pads will tend to cause plasticity in the materials and cause raflures.

[0021] In a first preferred embodiment the material used for forming the abrasive articles of the present invention is a true-thermoplastic polymer material which includes suitable abrasive particles interspersed homogeneously therethrough. The material used must be sufficiently formable, by melting, such that it may be forced to flow into and around the strengthening element if desired. Suitable thermoplastic materials include polycarbonates, polypropylenes, polyethylenes, nylons, polyurethanes, or other thermoplastics which can be thermomelted with heat and pressure to produce the abrasive pad 10 or 110. A preferred material is a polypropylene powdered material which may be mixed with diamond grit particles and/or silicon carbide type particles in its powdered form prior to the molding operation. Of course, other abrasive grit materials could be utilized in the present invention as will be readily appreciated by

those skilled in the art.

[0022] In the past, it has generally been thought that thermoplastics are not generally useful in abrasive grit particles due to the heat produced during use of abrasive pads, and the resulting decomposition and melting of such materials. However, in the present invention I have deviated from the prior art teachings by using thermoplastic materials which I have found to be suitable for such applications. Thermoplastics are desirable from a production standpoint in that thermoplastics are adaptable to injection molding. In a preferred embodiment of the present invention abrasive pads are injection molded in accordance with a process to be set forth below.

[0023] Referring now to Fig. 2, in accordance with a compression molding method (not in accordance with the present invention) a lower mold platen 128 is provided which has a series of spaced indentation portions 130 corresponding to the shape of the :desired protrusion in the resulting abrasive pad or sheet, such as sheet 110. An upper platen 132 is provided for placing a mixture of a thermoplastic material and an abrasive grit material under pressure, in the presence of heat, for forcing the thermoplastic and abrasive grit mixture into the indentations 130 of the mold platen 128. This forms a one-piece abrasive pad.

[0024] Thus, in accordance with these steps, it is first necessary to provide an intimate mixture of abrasive grit materials, secondary filler and a polymer material. This could be accomplished by mixing a powdered thermoplastic with an abrasive grit and secondary filler, in appropriate proportions, by melt mixing these constituents.

[0025] Thereafter, this mixture is placed in the mold platen 128 and the mixture is heated under pressure to form the resulting article 110 in the mold portion of the platen 128.

[0026] In a preferred embodiment of this compression molding method, a strengthening element, such as the phenolic board material 124, is placed in the platen such that the orifices 126 are in the same locations as the indentations 130 of the platen 128. Thereafter, a mixture of a thermoplastic material, abrasive material and secondary filler is placed on top of this. The platen 132 is then lowered on the above constituents in the presence of heat which thermoplastically deforms the plastic material with the abrasive grit and secondary filler intermixed therein and forces it through the orifices 126 and into the indentations 130 of the lower platen 128.

[0027] In an alternate embodiment of this compression molding method, such as that shown in Fig. 4, the fiberglass or other mesh material, which is utilized as a strengthening element, may be placed on the platen 128 and thereafter the thermoplastic material is pressed through the apertures and the strengthening element to form the final abrasive pad or structure, as shown in Fig. 4.

[0028] Referring now to Figs. 5-7, there is shown an embodiment of a pad made in accordance with the teachings of the present invention wherein injection molding is used to produce the pad 210. The pad 210 includes a series of pie slice shaped areas, generally indicated at 212, around the circumference of the pad 210. These areas are separated by radial slotted portions, generally indicated at 214. The pie shaped segments 212 include a series of flattened stub protrusions 216 interspersed amongst these pie shaped areas 212 These protrusions are formed by the mold surfaces of an injection type mold cavity configuration. The rear side of the pad 210 includes a hollowed out circumferential portion 218 which has an inner lip 220 and an outer lip 222 which extend axially for supporting the pad on the tool support structure. The protrusions 224 are spaced throughout the backside and are at a co-planar level with the axial extending lips 220 and 222 for providing support throughout the pad area.

[0029] In an alternate embodiment of an abrasive pad of the present invention, in order to save grit material the backing substrate may be first injection molded with an abrasive free polypropylene and thereafter the abrading protrusions 216 may be injection molded onto the backing substrate as a separate function. In such an embodiment, the protrusions will contain the grit matrix material but will be melt bonded to the backing substrate which contains no grit material. Since the materials are identical or at least melt bondable to one another the resulting pad is a strong one-piece structure. Thus, in accordance with this aspect, grit material is placed only in the areas required by the abrasive protrusions and is not wasted as becoming part of the backing substrate or the like.

[0030] In accordance with the broad aspects of the process of the present invention, a thermoformable polymer such as a thermoset or thermoplastic and abrasive grit material are provided in an intimate mixture suitable for injection molding. Thereafter an injection molding apparatus is provided for thermoforming the abrasive grit, secondary filler and polymer mixture. The abrasive article is then formed by thermoforming the mixture with the injection molding apparatus to form the abrasive article. The article is then allowed to cool to set the abrasive article. The thermoplastic material utilized is preferably a true thermoplastic such as that set forth above, however, in an alternate embodiment a thermoset may be utilized. In a particularly preferred embodiment an injection molding process is used as follows.

[0031] In accordance with the injection molding process of the present invention, an abrasive article may be made with or without a strengthening element sheet inserted therein by the following steps. First a suitable injection mold structure or cavity is prepared and provided in which the article shape is set forth in an injection mold machine. Thereafter, a thermoplastic material, preferably a polypropylene or the like, is mixed with abrasive grit material, for instance from about 2 micron to about 300 micron sized diamond grit particulate matter and suitable secondary fillers such as silicon carbide, aluminum-oxide, copper-powder, aluminum powder, silica fib-

erglass or the like in appropriate proportions. Thereafter, the mixture is molded at a temperature above the softening point of the thermoplastic material and injected into the mold to produce the thermoplastic one-piece pad. In a preferred embodiment, the thermoplastic preferably has a melting temperature above about 100°C and would be molded at a temperature of 440°F (about 226°C) using 6894 $\times$ 10^3 Pa (1,000 psi) with 344 $\times$ 10^3 Pa (50 pounds) of back pressure. It is believed that the clamped cycle time would be an effective time such as about 12 seconds.

[0032] While diamond grit material is preferred as the primary abrasive grit other diamond hardness abrasive grits can be substituted as will be readily appreciated to those skilled in the art.

[0033] If a strengthening element is desired such an element could be placed into the mold prior If a strengthening element is desired such an element could be placed into the mold prior to the injection molding process. This allows for molding of the strengthening element into the pad itself. Similarly, an abrasive structure could be formed on a substrate by injection molding of the abrasive structure onto the substrate.

[0034] Thermoplastics for use in injection molding which provide proper structure in the final abrasive structure have the following characteristics. Preferably, the thermoplastics will have a softening point of greater than 100°C and preferably less than 250°C and densities of between 3.0 and 4.92 g/cm^2 and preferably between 3.0 to 4.0. Suitable thermoplastic materials include polypropylenes, polyethylenes, low density polyethylenes, high density polyethylenes, nylons and polycarbonates with melt ranges varying from about 100°C to about 250°C. Such abrasive structures must be able to withstand beat generated during grinding without deteriorating, thus suitable materials have melting ranges of from about 100°C to about 250°C. Suitable low density polyethylenes include Hifax™ types manufactured by Himont. Suitable polypropylenes are those such as Profax™ obtained from Himont. A suitable high density polyethylene is a Paxon™ brand obtained from Allied Corp. Nylon 66 and Nylon 12 are suitable and Lexan™ polycarbonate obtained from G.E. Plastics is also suitable.

[0035] In order to enhance the life of the thermoplastic abrading articles of the present invention, in addition to diamond grit material, secondary abrasive grit fillers are utilized in the thermoplastic articles of the present invention. Such secondary fillers provide abrasive to the work surface in areas where diamond grit is absent thereby enhancing abrasion resistance of the tool and protecting the diamond grit from premature dislodgement. In a preferred embodiment, such secondary fillers may include abrasives such as silicon carbide, aluminum oxide and corundums as examples or may be selected from fillers such as powder metals, powder organic material, powdered inorganic materials and mixtures thereof. As stated above, thermoplastic abrasive compositions include from about 5% to about 80% by volume secondary fillers; from 1% to 20% by volume diamond grit and from 5% to 90% by volume thermoplastic material, which thermoplastic is preferably in the range of from 20% to 60%.

[0036] Thus, utilizing these teachings, various abrasive structures can be produced. For instance, a grinding wheel type abrasive structure can be produced by first selecting a core structure which is compatible for injection molding of an abrasive mixed with a thermoplastic as set forth above. Many other shapes or forms can be produced via the injection molding of the abrasive grit intermixed with the thermoplastic. For instance, diamond wheels, hand sanding pads, rotary edge polishing pads, lapping tools, or the like are possible as articles of manufacture of the present invention.

[0037] Referring now to Figs. 8 through 11, there is shown a cylinder type lapping tool 310 produced in accordance with the teachings of the present invention. Lapping tool 310 is a one-piece tool injection molded in accordance with the teachings of the present invention. Lapping tool 310 includes a front face 312 and a back surface 314. The front face 312 has a lapping tool curvature for finish grinding of a lens. The back surface includes structure for attachment to a lapping machine.

[0038] Referring to Figs. 10 and 11, the lapping tool 310 is made of a thermoplastic 316 with diamond grit particles 318 and secondary filler particles 320 interspersed therethrough.

[0039] Lapping tools made in accordance with the teachings of the present invention have demonstrated improved finishing of lenses in that they can rough grind and finish grind lenses using the same tooL Using conventional procedures such operations require two separate steps. Thus, the lapping tools of the present invention provide an unexpected benefit over conventional tools.

[0040] Abrasive articles can also be produced in accordance with the present invention by injection molding of thermoset plastics which are intermixed with an abrasive grit material and a secondary filler, in appropprite proportions, for thermoset type injection molding. Thermoset articles would be useful with abrasive grit and filler content set forth above. Of course, as will be readily appreciated by those skilled in the art, thermoset injection molding techniques and equipment must be utilized when producing such abrasive articles.

[0041] Injection molded pads have greater homogeneity in grit distribution due to the inherent mixing involved during the process and quick setting times. Thus, abrasive articles produced in accordance with the injection molding teachings have superior abrasive qualities over those produced by other processes.

[0042] Further understanding of the present invention may be obtained by reference to the following examples which are given as further illustration of the present invention and is not to be construed to be limiting to the present invention.

Example I

[0043] A mold was prepared wherein a 8.89 cm (3.5 inch) diameter cavity was made with a 45° outer ramp flange 0.40 cm(.156 inches) wide and having a 2.2 cm (.875 inch) center hole. One face of the mold is planar and flat but includes surfaces for forming an inner and outer backing lip with six pairs of concentrically spaced supporting protrusions on the bottom surface and a pad. The upper working surface includes surfaces for forming a series of 0.13 cm (.05 inch) diameter abrasive protrusions which extend .05 inches to .06 inches in pie shaped areas which are mounted to a 0.04 cm (.015 inch) thick web. Six spaced radially extending surfaces for forming slots in a final pad are equiangularly spaced between these pie shaped areas and are 0.46 cm (.180 inches) wide. These are angularly spaced radially from the center hole to the outer edge.

[0044] A mixture of 50 grams of a polypropylene powder having product code number PC 072 PM, obtained from Himont Corporation of Troy, Michigan, which has a melt grade of 6 to 9 was mixed with 30 grams of a silicon carbide 600 grit abrasive material and 15 grams of a diamond 20/40 micron material.

[0045] An injection molding apparatus having three heat zones was utilized. A mold with a heated nozzle and a carbide gate and shut off plunger were used in an injection molding apparatus having three heat zones. The above mixture material is injection molded at a temperature of 227°C (440°F) using 6894 $\times$ 10^3 Pa (1,000 psi) and 344 $\times$ 10^3 Pa (50 pounds) of back pressure. The mold base was water cooled and the clamp to clamp cycle time was about approximately 12 seconds. After the molding was completed a pad was removed and was found to be suitable for long life marble or stone polishing.

Example II

[0046] A mold was prepared wherein a 8.9 cm (3.5 inch) diameter cavity was made with a 45° outer ramp flange 0.40 (.156 inches) wide and having a 2.2 cm (. 875 inch) center hole. One face of the mold is planar and flat but includes surfaces for forming an inner and outer backing lip with six pairs of concentrically spaced supporting protrusions on the bottom surface and a pad. The upper working surface includes surfaces for forming a series of 0.12 cm (.05 inch) diameter abrasive protrusions which extend 0.12 cm (.05 inches) to 0.15 cm (. 06 inches) in pie shaped areas which are mounted to a 0.04 cm (.015 inch) thick web. Six spaced radially extending surfaces for forming slots in a final pad are equiangularly spaced between these pie shaped areas and are 0.48 cm (.180 inches) wide. These are angularly spaced radially from the center hole to the outer edge.

[0047] A mixture of 50 grams of a polypropylene powder having product code number PC 072 PM, obtained from Himont Corporation of Troy, Michigan, which has a melt grade of 6 to 9 was mixed with 30 grams of a silicon carbide 600 grit abrasive material and 15 grams of a diamond 20/40 micron material.

[0048] An injection molding apparatus having three heat zones was utilized. A mold with a heated nozzle and a carbide gate and shut off plunger were used in an injection molding apparatus having three heat zones. The above mixture material is injection molded at a temperature of 227°C (440°F) using 10341 $\times$ 10^3 Pa (1,500 psi) and 6894 $\times$ 10^3 Pa (1,000 pounds) of back pressure. The mold base was water cooled and the clamp to clamp cycle time was about approximately 30 seconds. After the molding was completed a pad was removed and was found to be suitable for long life marble or stone polishing.

EXAMPLE III

[0049] Injection molded lens lapping cylinder tools were produced in a conventional injection molding machine as follows.

[0050] Introduced into the barrel of the machine was 2200 grams of a mixture of 57% by weight polypropylene resin, 29% by weight 3 micron aluminum oxide powder and 14% by weight grit particles of diamond 600 grit

[0051] The rear heating station of the injection molding machine was maintained at a temperature of 177°C (350°F). The middle heating station was maintained at a temperature of 188°C (370°F). The nozzle was maintained at a temperature of 210°C (410°F). The lapping tools were molded at a temperature of 6894 $\times$ 10^3 Pa (1000 psi) with 344 $\times$ 10^3 Pa (50 pounds) of back pressure and a cycle time of 1:20:00 minutes.

[0052] The resultant product were lens lapping cylinder tools weighing 250 grams each.

[0053] The resulting product was installed on a cylinder lapping machine and found to be suitable for both fine grinding and polishing. The lapping tool produced was used to fine grind a plastic lens in 1.5 minutes and to polish a plastic lens in 4.0 minutes.

Claims

1. An abrasive article comprising a moulded abrading body produced from an injection moulded polymeric material with an abrasive material and a secondary filler material interspersed homogeneously therethrough, the abrading body comprising from 1% to 20% by volume of a diamond hardness abrasive grit; from 5% to 80% by volume of a secondary filler; and from 5% to 90% by volume of a thermoformable polymer selected from thermoplastic polymeric materials having a softening point temperature greater than 100°C and less than 250°C, and thermoset polymers.

2. An abrasive article according to claim 1, wherein the

secondary filler is selected from silicon carbides, aluminium oxides, corundums and mixtures thereof.

3. An abrasive article according to claim 1, wherein the secondary filler is selected from powder metals, powdered organic materials, powdered inorganic materials and mixtures thereof.

4. An abrasive article according to any preceding claim, which includes a substrate, with the body injection moulded onto a substrate.

5. An abrasive article according to any preceding claim, wherein the thermoplastic polymeric material is selected from polypropylenes, polyethylenes, nylons, polycarbonates and mixtures thereof.

6. A process of manufacture of an abrasive article, comprising the steps of:

a) providing an injection mould cavity for forming a predetermined shape of the abrasive article;
b) formulating a fluid mixture, said mixture comprising from 1% to 20% by volume diamond hardness abrasive grit, from 5% to 80% by volume secondary filler(s) and from 5% to 90% of a thermoformable polymer selected from thermoplastic polymers having a softening point temperature greater than 100°C and less than 250°C and thermoset polymers; and
c) injection moulding the abrasive article by forcing the fluid mixture into the injection mould cavity.

Patentansprüche

1. Abrasiver Gegenstand, beinhaltend einen gegossenen Abrasionskörper, hergestellt durch Spritzgießen von Polymermaterial mit einem Abrasionsmaterial und einem zweiten Füllmaterial homogen dazwischen, wobei der Abrasionskörper 1 bis 20 Vol. % eines Abrasionsguts mit Diamanthärte enthält, 5 bis 80% Vol.% eines zweiten Füllmaterials und 5 bis 90 Vol.% eines wärmeformbaren Polymers, ausgewählt aus thermoplastischen Polymermaterialien mit einem Erweichungspunkt von mehr als 100°C und weniger als 250°C und thermohärtende Polymere.

2. Abrasionsgegenstand nach Anspruch 1, wobei der zweite Füller ausgewählt ist aus Siliciumcarbiden, Aluminiumoxiden, Korunden und Mischungen hiervon.

3. Abrasionsgegenstand nach Anspruch 1, wobei das zweite Füllmaterial ausgewählt ist aus Metallpulvern, pulverisierten organischen Materialien, pulverisierten anorganischen Materialien und Mischungen hiervon.

4. Abrasionsgegenstand nach irgendeinem vorhergehenden Anspruch, der ein Substrat beinhaltet, wobei der Körper auf ein Substrat spritzgegossen ist.

5. Abrasionsgegenstand nach irgendeinem vorhergehenden Anspruch, wobei das thermoplastische Polymer ausgewählt ist aus Polypropylenen, Polyethylenen, Nylonen, Polycarbonaten und Mischungen hiervon.

6. Verfahren zur Herstellung eines Abrasionsgegenstandes, umfassend die Schritte

a) Bereitstellen eines Spritzgusshohlraums zur Ausbildung einer vorgegebenen Form des Abrasionsgegenstandes;
b) Formulieren einer Flüssigmischung, wobei die Mischung 1 bis 20 Vol.% Abrasionsgut mit Diamanthärte enthält, 5 bis 80 Vol.% von einem oder mehreren zweiten Füller(n) und 5 bis 90 % wärmeformbaren Polymers, ausgewählt aus thermoplastischen Polymeren mit einem Erweichungspunkt von mehr als 100°C und weniger als 250°C sowie thermohärtenden Polymeren; und
c) Spritzgießen des Abrasionsgegenstandes durch Pressen der Flüssigmischung in den Spritzgusshohlraum.

Revendications

1. Article abrasif, comprenant un corps abrasant moulé, produit à partir d'un matériau polymère moulé par injection dans lequel un matériau abrasif et une charge secondaire se trouvent partout, en interdispersion homogène, ledit corps abrasant comportant 1 à 20 % en volume de particules abrasives ayant une dureté équivalente à celle du diamant, 5 à 80 % en volume d'une charge secondaire, et 5 à 90 % en volume d'un polymère façonnable à chaud, choisi parmi les polymères thermoplastiques dont la température de ramollissement est supérieure à 100 °C et inférieure à 250 °C, et les polymères thermodurcissables.

2. Article abrasif conforme à la revendication 1, dans lequel la charge secondaire est choisie parmi les carbures de silicium, les oxydes d'aluminium, les corindons et leurs mélanges.

3. Article abrasif conforme à la revendication 1, dans lequel la charge secondaire est choisie parmi les

métaux en poudre, les matières organiques en poudre, les matières inorganiques en poudres et leurs mélanges.

4. Article abrasif conforme à l'une des revendications précédentes, qui comporte un substrat sur lequel le corps abrasant est moulé par injection.

5. Article abrasif conforme à l'une des revendications précédentes, dans lequel le polymère thermoplastique est choisi parmi les polypropylènes, les polyéthylènes, les polyamides, les polycarbonates et leurs mélanges.

6. Procédé de fabrication d'un article abrasif, qui comporte les étapes suivantes :

a) prendre une cavité de moulage par injection, adaptée pour donner à l'article abrasif une forme définie au préalable ;
b) formuler un mélange fluide, qui contient 1 à 20 % en volume de particules abrasives ayant une dureté équivalente à celle du diamant, 5 à 80 % en volume d'une ou de plusieurs charges secondaires, et 5 à 90 % en volume d'un polymère façonnable à chaud, choisi parmi les polymères thermoplastiques dont la température de ramollissement est supérieure à 100 °C et inférieure à 250 °C, et les polymères thermodurcissables ; et
c) mouler par injection l'article abrasif en faisant pénétrer de force le mélange fluide dans la cavité de moulage par injection.

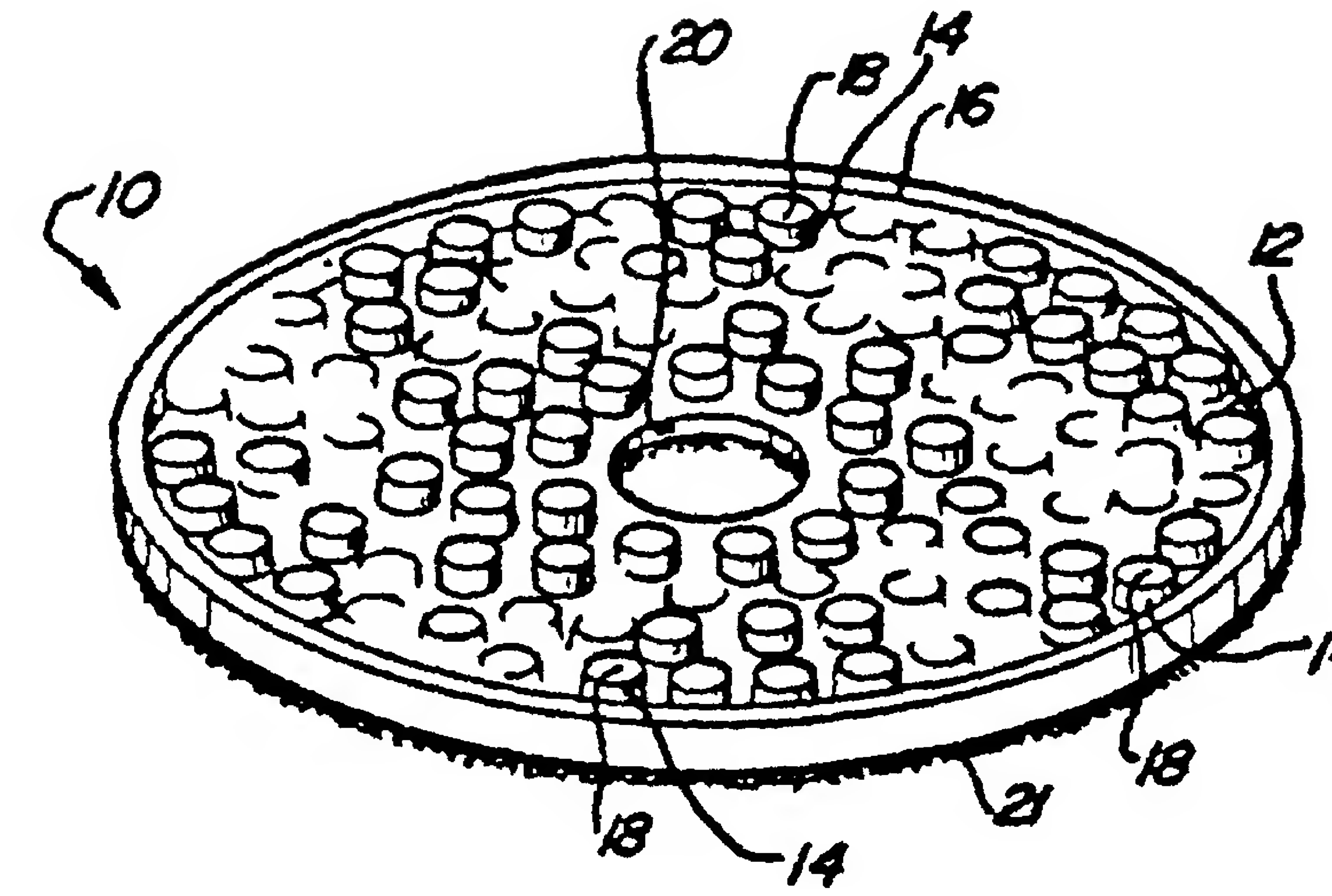

Fig-1

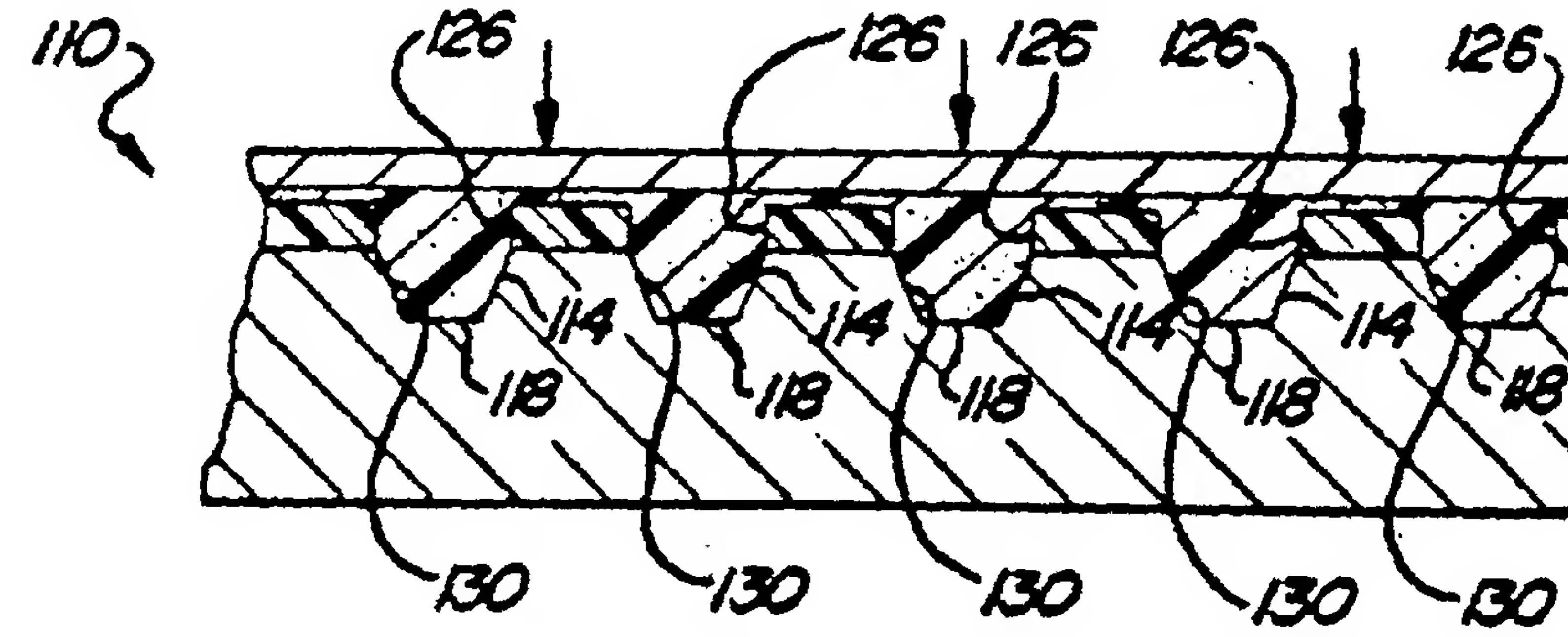

Fig-2

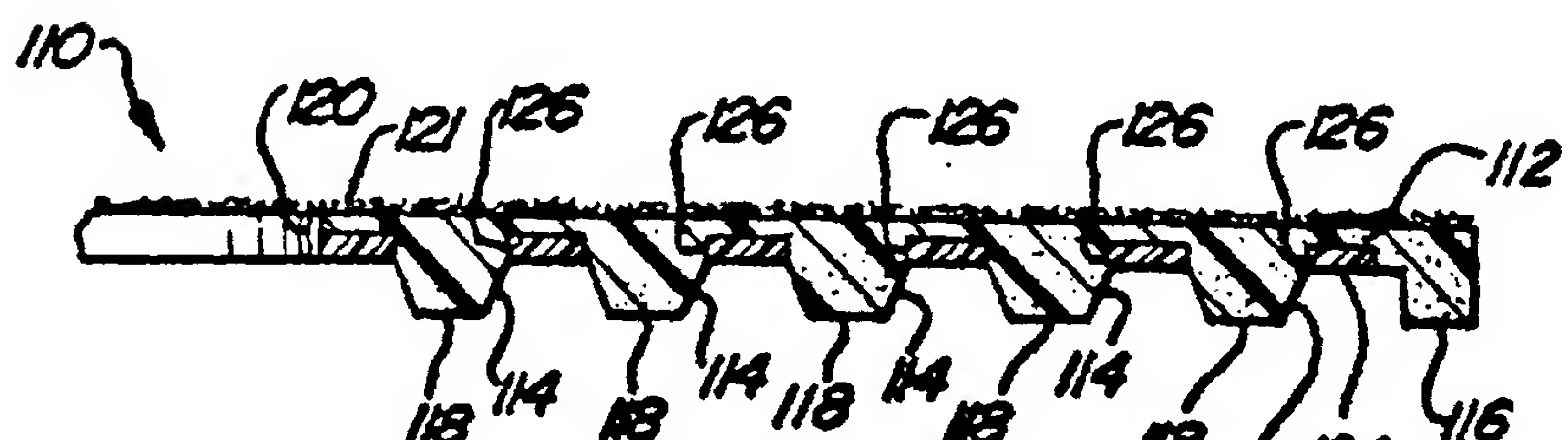

Fig-3

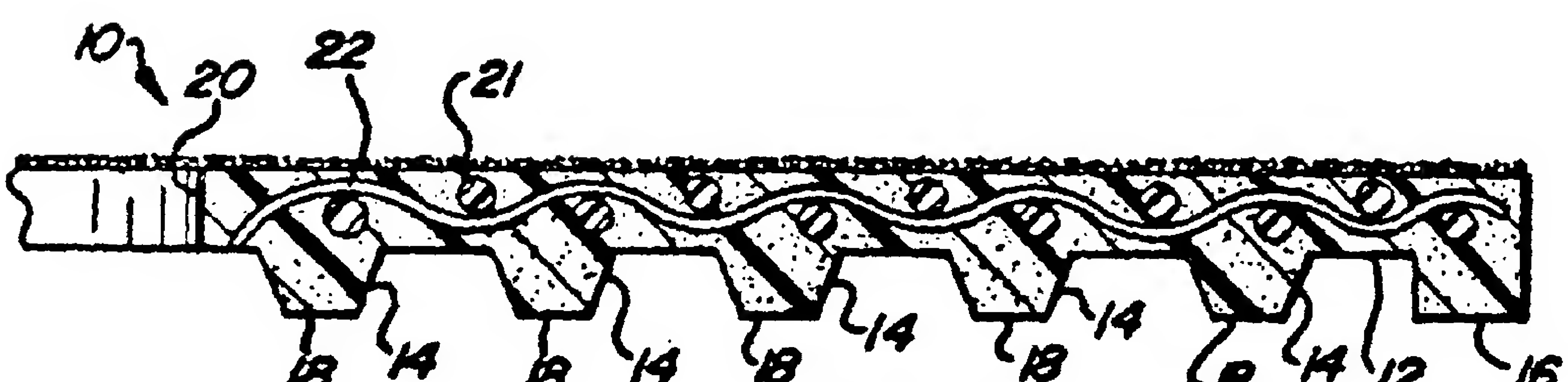

Fig-4

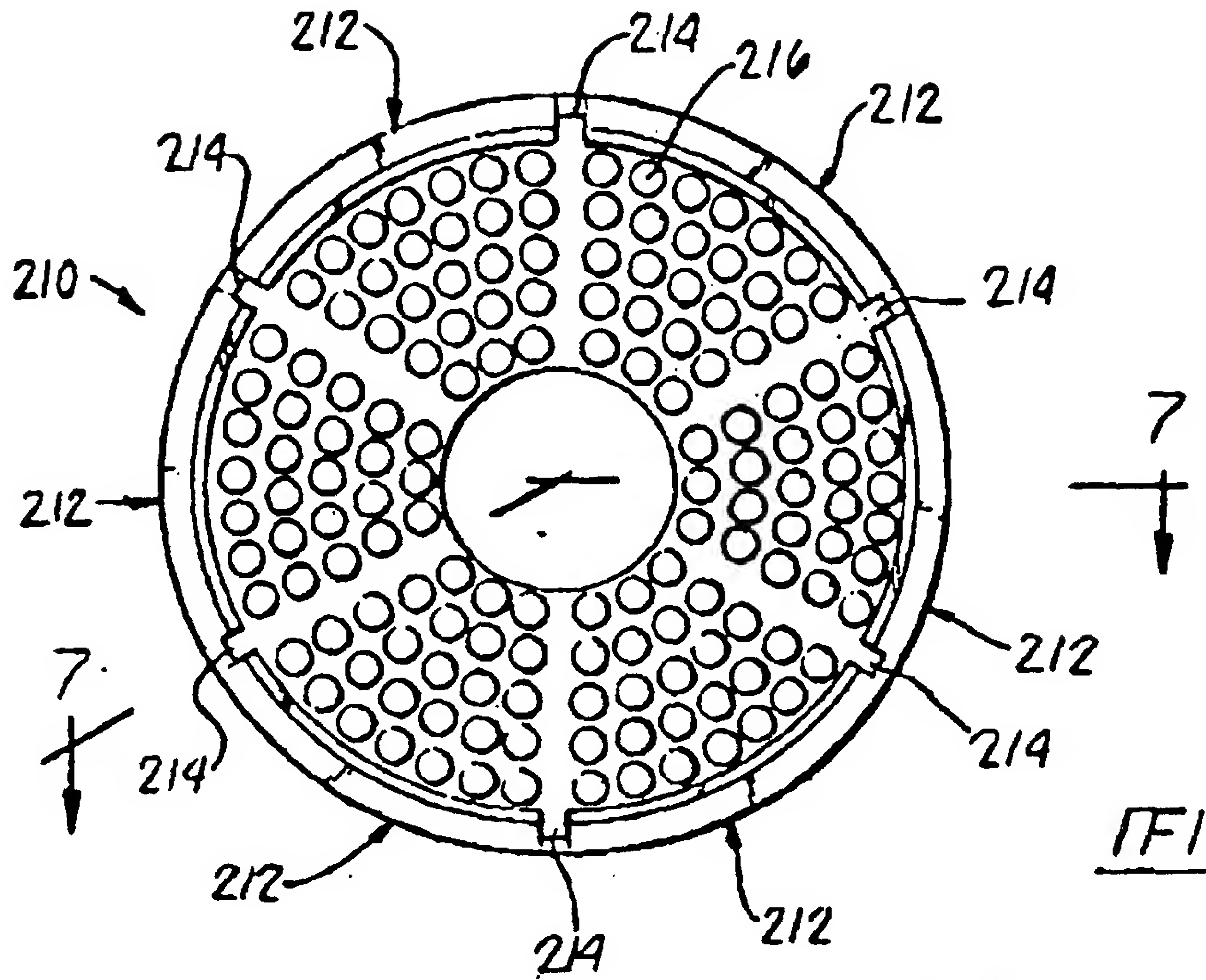

FIG-5

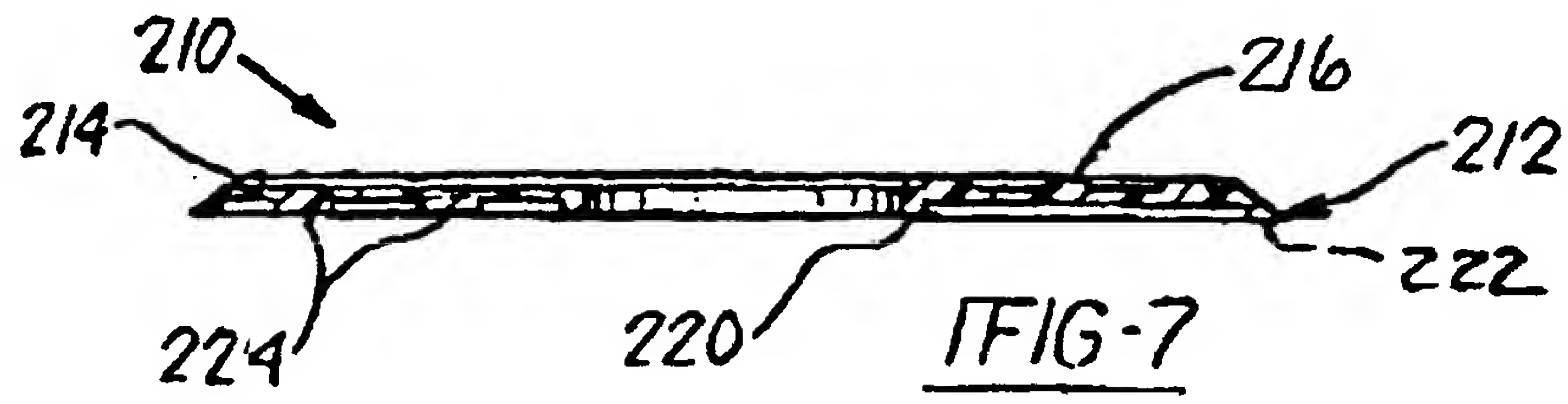

FIG-7

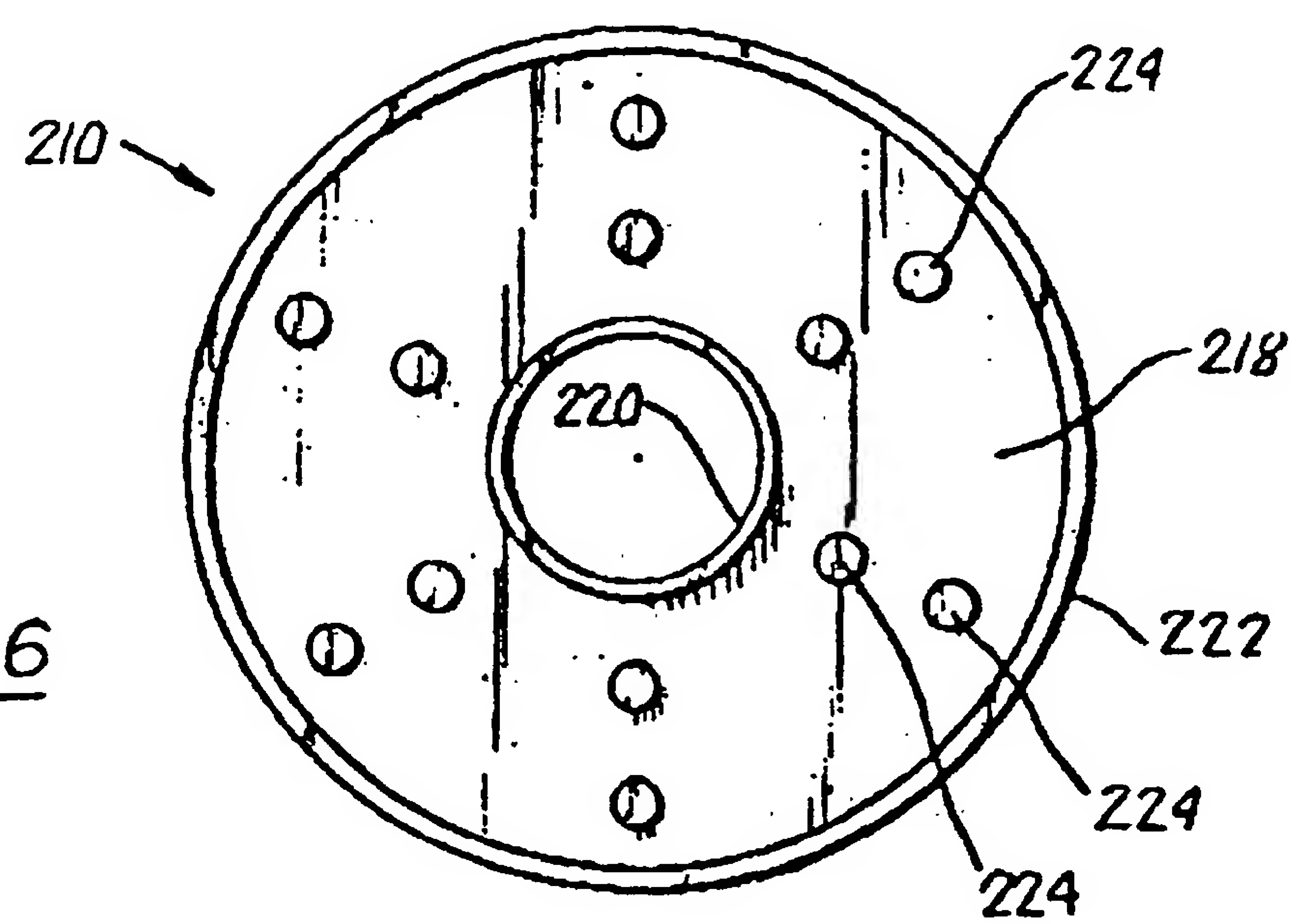

FIG-6

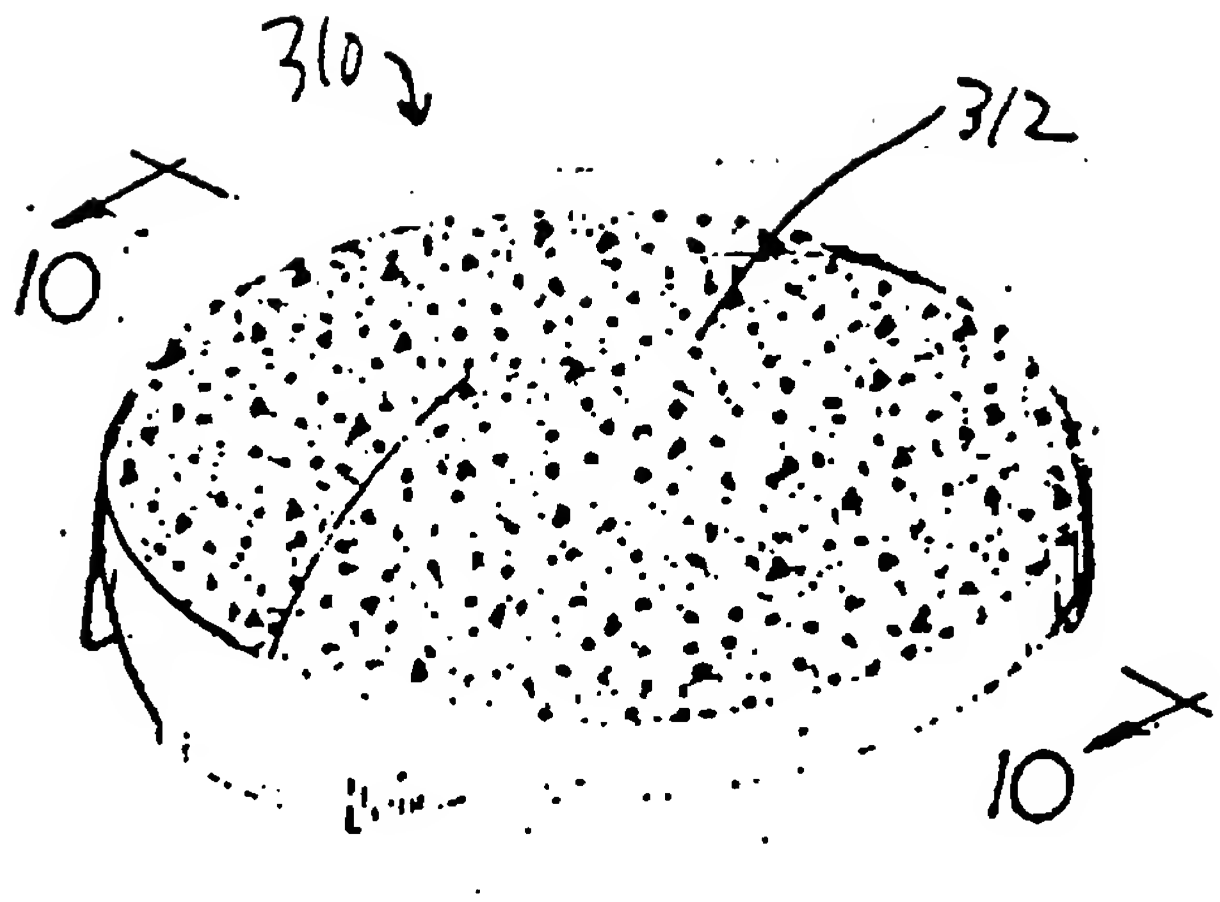

FIG-8

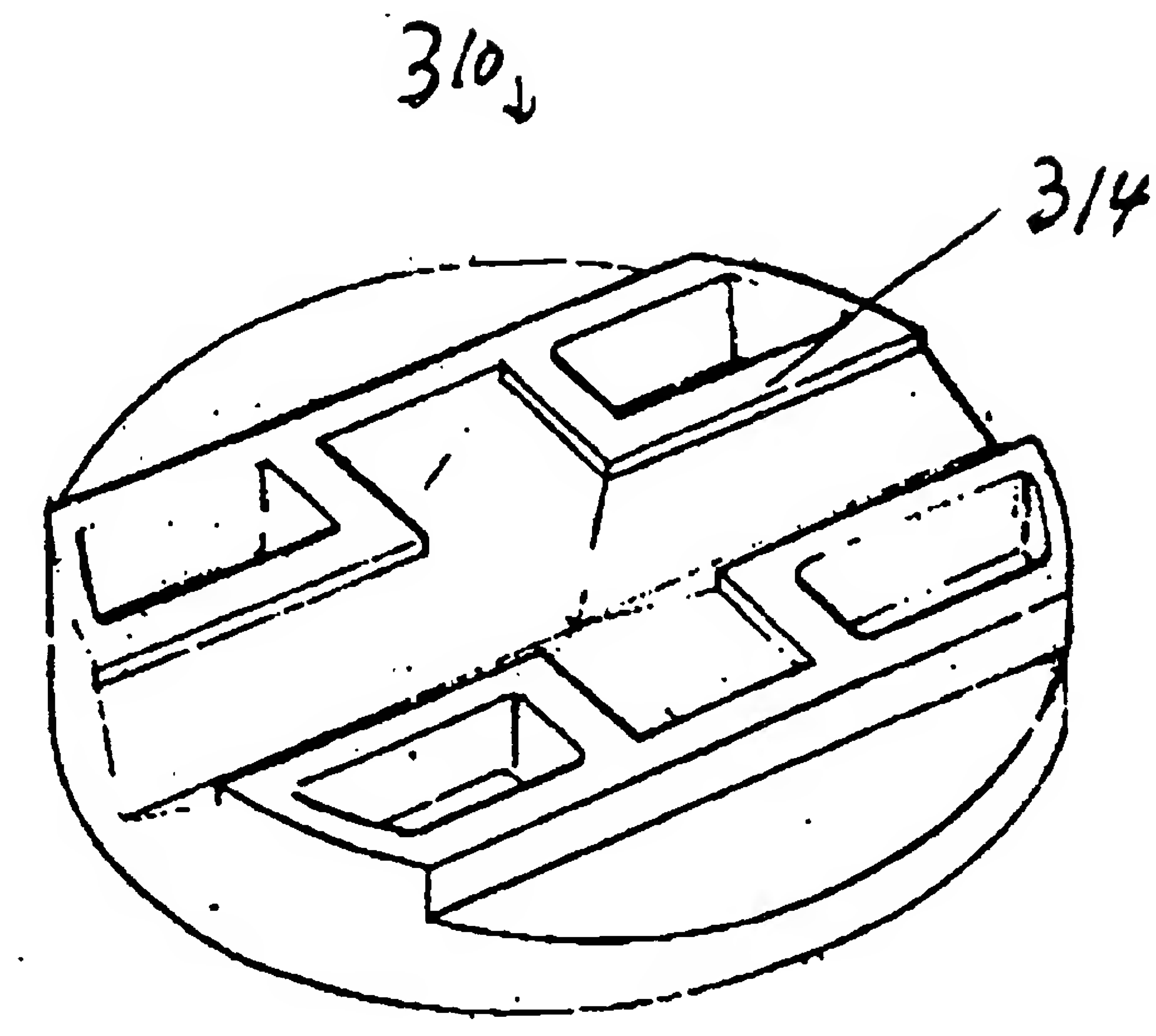

FIG-9

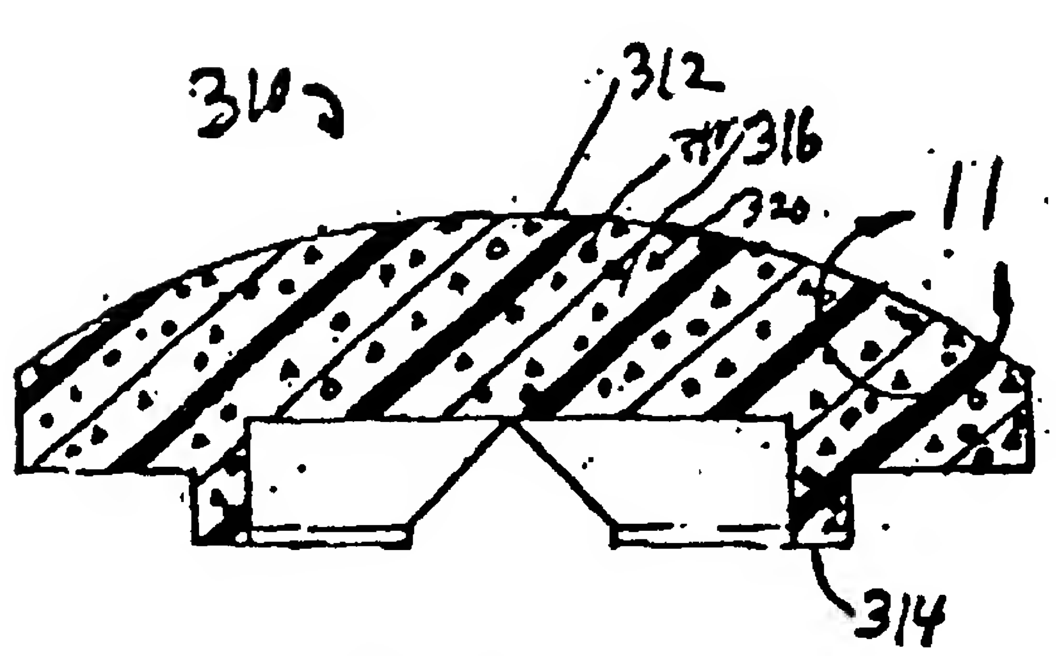

FIG-10

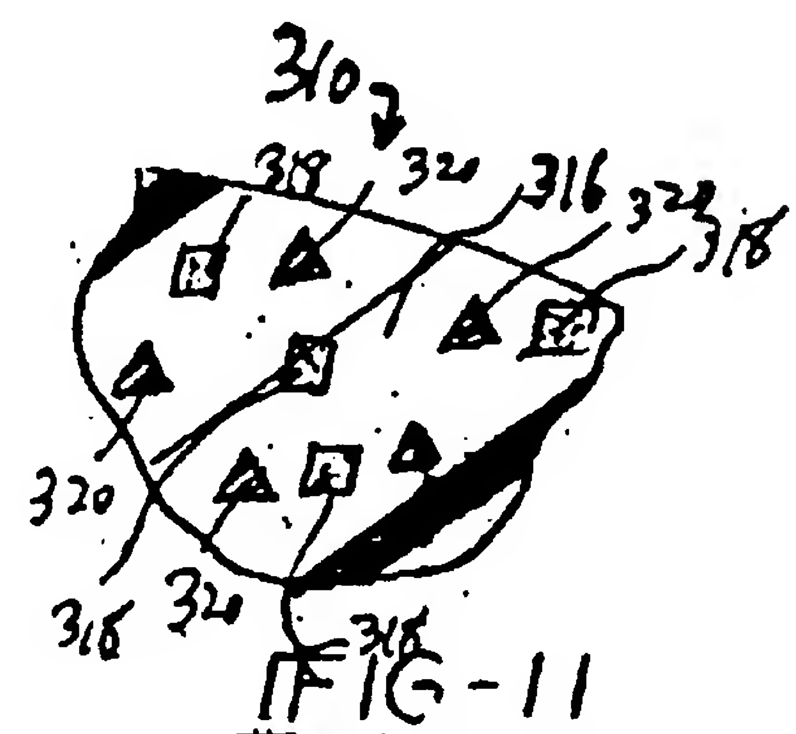

FIG-11